

HISTORICAL OVERVIEW OF NUCLEAR DATA EVALUATION IN INTERMEDIATE ENERGY REGION

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In recent years, intermediate energy nuclear data are required for various applications such as accelerator-driven systems for nuclear waste transmutation, spallation neutron sources, advanced cancer therapies with particle beams, estimation of single event up set rate and dose on astronauts, and so on. Proton and photon data as well as neutron data are necessary in these intermediate energy applications. To meet these requirements, many groups in the world continue some activities concerning nuclear data evaluation in the energy range above 20 MeV, which is the upper limit of conventional general purpose evaluated nuclear data files.

The early stage of nuclear data evaluation in the intermediate region was initiated in USA. For example, Pearlstein at National Nuclear Data Center, Brookhaven National Laboratory produce some systematics, modified ALICE code produced by Blann and evaluated proton and neutron intermediate nuclear data of Fe-56 in late 1980s. At Lawrence Livermore National Laboratory, the intermediate nuclear data also developed for a medical application in nearly the same period. Following these efforts, many countries, such as Europe, Japan, Russia, People Republic of China, Korea, started the preparation of nuclear data in this energy region.

Nuclear data evaluation is generally carried out on the basis of experimental data and theoretical model calculations. However, the experimental data are sparse for neutron-induced reactions in the intermediate energy region and systematic measurements are not enough for proton data. Therefore, theoretical model calculations play a major role in the intermediate energy nuclear data evaluation. The statistical model with correction of pre-equilibrium process is mainly applied in the intermediate energy region. For energies higher than 150 MeV, the Quantum Molecular Dynamics (QMD) plus statistical decay model and the intranuclear cascade (INC) plus generalized evaporation model (GEM) are employed in Japan. The systematics based on experimental data is also applied for evaluation of total, elastic, proton reaction and fission cross sections for the intermediate energy region.

Overview of intermediate nuclear data evaluation methods, some results of the evaluations are presented in comparison between experimental data and evaluated files, mainly JENDL High Energy File, as well as some results from integral benchmark calculations.